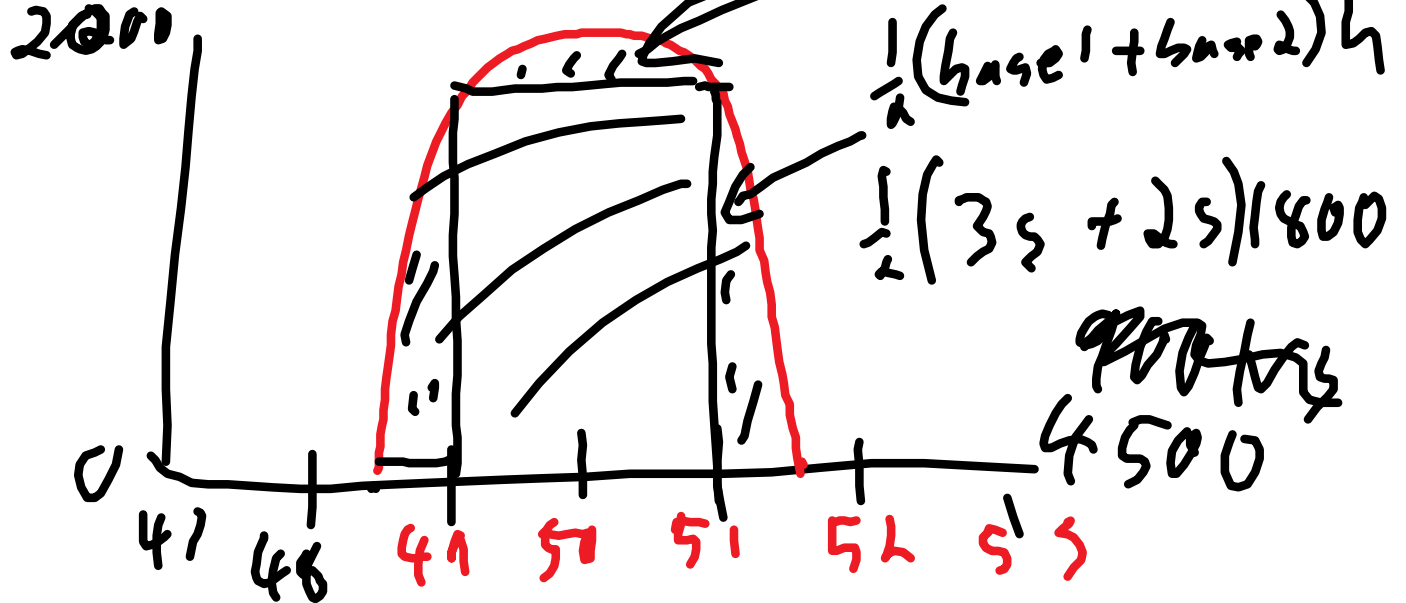


Go over homework/lab
hand in lab

Introduce Work and Energy

p179 Q4



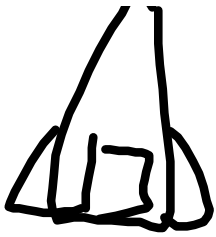
$$360 \text{ N} \cdot \text{s} + 4500 \text{ N} \cdot \text{s} = 4860 \text{ N} \cdot \text{s}$$

$$\boxed{4.9 \text{ N} \cdot \text{s}}$$

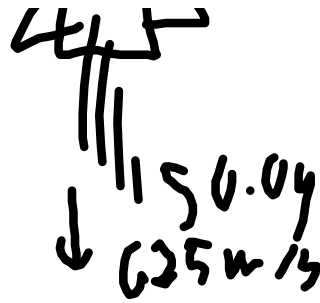
p188

Q9





$$P_i = 0$$



$$P_f = P_{\text{rock}} + P_{\text{fuel}}$$

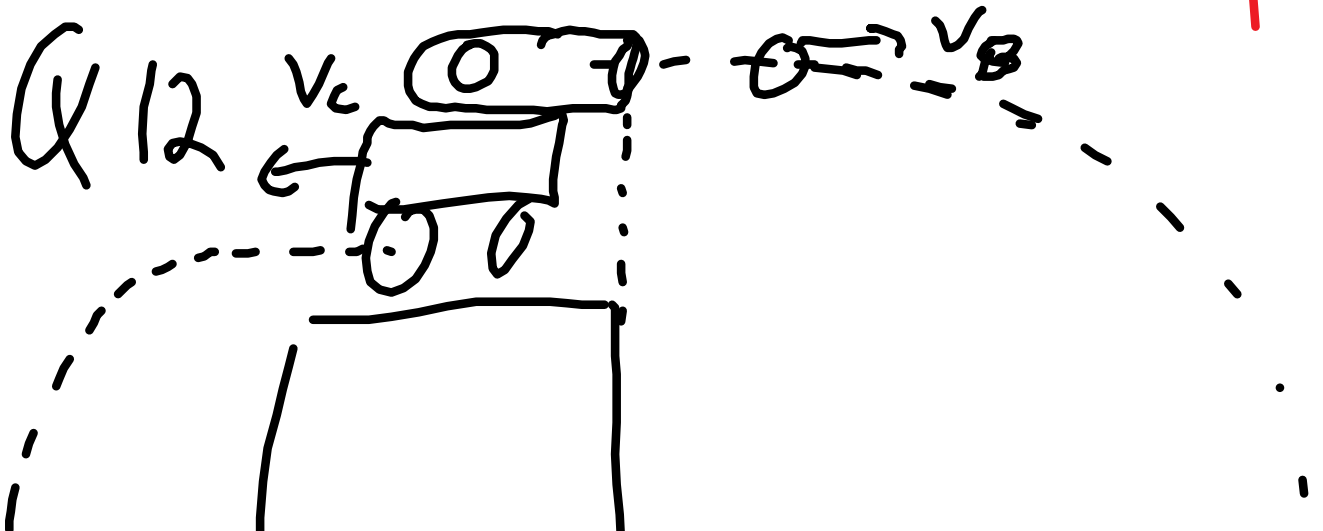
$$\sum P_i = \sum P_f$$

$$0 = m_r V_r + m_f V_f$$

$$0 = 4 \text{ kg } V_r + 0.050 \text{ kg } (625 \text{ m/s})$$

$$V_r = -7.8 \text{ m/s}$$

opposite the fuel





$$\frac{d_B}{d_c} = \frac{V_B}{V_c}$$

$$\sum P_i = \sum P_f$$

$$0 = m_B V_B + m_c V_c$$

$$\frac{-m_c V_c}{m_B V_c} = \frac{m_B V_B}{m_B V_c}$$

$$-\frac{m_c}{m_B} = \frac{V_B}{V_c} = \frac{d_B}{d_c}$$

$$d_c = \frac{m_B d_B}{m_c}$$

$$d_c = \frac{(4.5 \text{ kg})(215 \text{ m})}{225 \text{ kg}}$$

danny

$$d_c = -4.3m$$

New Chapter: Work, Power, Efficiency (chapter 10)

Need 3 Students to Demonstrate work.

Who is doing more work?

Sunny holding heavy books, not moving.

Nathaniel lifting a piece of paper.

Erin walking with a plate and mass.



Thora - work is related to effort
Sunny is doing most work

Jeffery - Erin because she has
lots to deal with,

Sunny - Nathaniel is doing
most work because
- continuous motion

If you google it, there are two definitions
you get.

1. Work is a change in energy.

What is energy? The ability to do
work. (not helpful)

2. Physical work - vector dot product
of force and displacement.

multiply the force in the direction of
the displacement.

$$W = Fd$$

W is zero if the force and
displacement are perpendicular.

W is negative if F is opposite d.

If we use the first definition, Sunny was using lots of biological energy to hold the books, so he was doing work but there was no work done on the books themselves.

If we use the second definition, Nathaniel is doing work, he has a force acting through a displacement. Erin's force is perpendicular to the d. Sunny has no d, so only Nathaniel is doing any work at all.

eg. A 50.0 kg student runs up a set of stairs 4.0 m long and 5.0 m high.

1. What is the work done

- a) by the student
- b) by gravity
- c) by the normal force
- d) by friction

2. if the student took the elevator, what are the answers to a,b,c,d?

p199 Q1-4

Field trip: Astronomer from UBC -
physics of stars, cosmology, dark
matter/energy, black holes.

a) $w = fd = mgd = 50\text{kg} \cdot 9.8\text{N/kg} \cdot (5.0\text{m})$
only need the F in the direction of d
 $W = 2450 \text{ Nm} = 2450 \text{ J}$
 J is Joule, a Nm also the unit for
energy

b) $W = -2450\text{J}$
negative if F is opposite d

c) 0J no d

d) $0 \text{ J no } d^2$

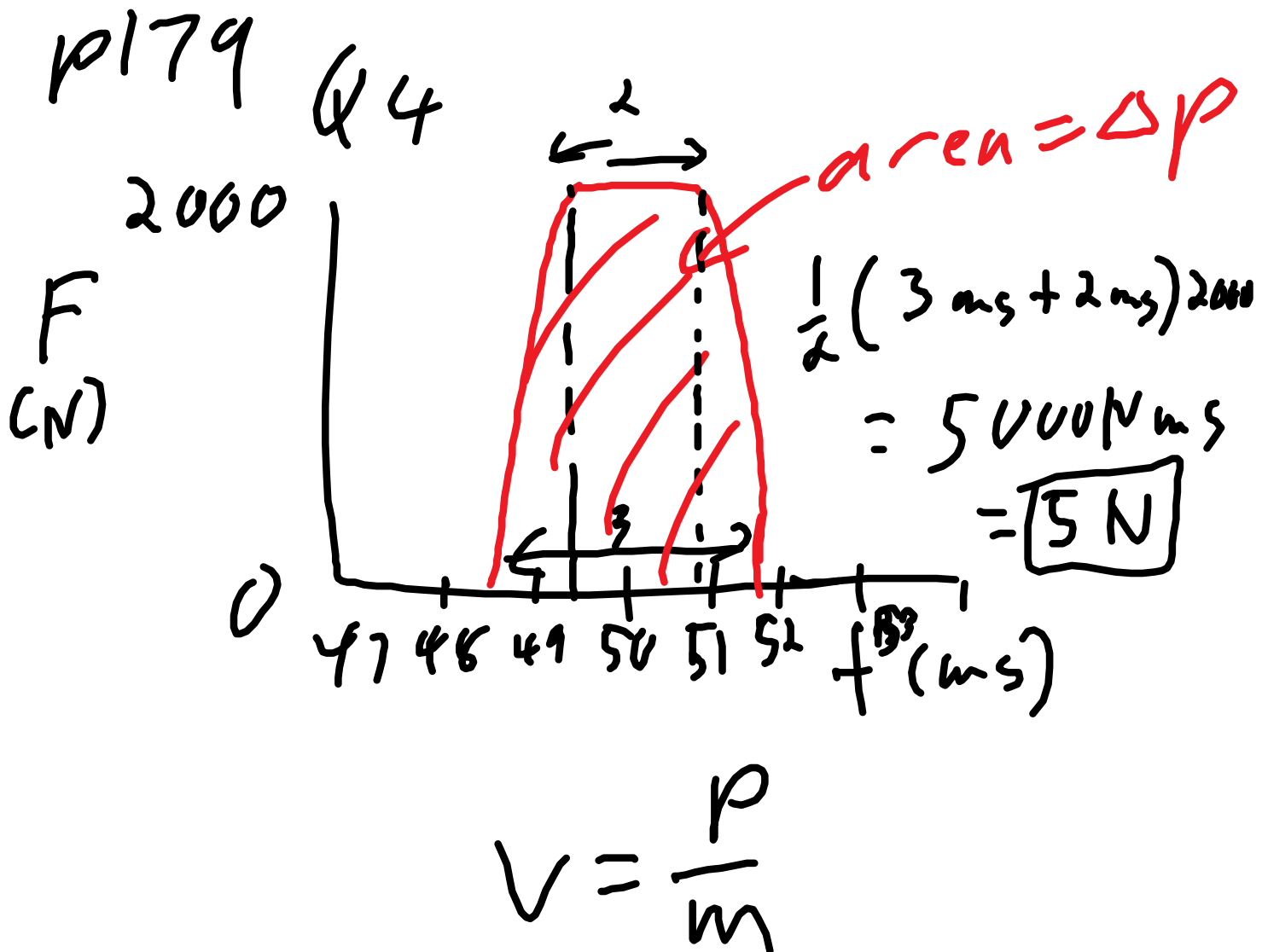
a) $W = 0$

b) -2450J

c) $+2450\text{J}$ by Normal force

d) 0J by friction

Go over homework/lab
hand in lab
Introduce Work and Energy



Work, Power, Efficiency (Chapter 10)

3 students to demonstrate work
Who is doing more work?

Natalie was holding a couple of books motionless.

Tara was walking with a plate and a mass on it.

Josephine was lifting a piece of paper.

Amber's theory: all doing the same.

Tara's theory: Natalie is doing the most because it is counter intuitive. (does seem to make sense)

definition of Work: common usage is different than physics definitions.

2 definitions:

Fulin: related to energy:

1. Work is a change in energy.

What is energy? Energy is the ability to do work. (not helpful)

2. Physical work is defined as the vector dot product of force and displacement.

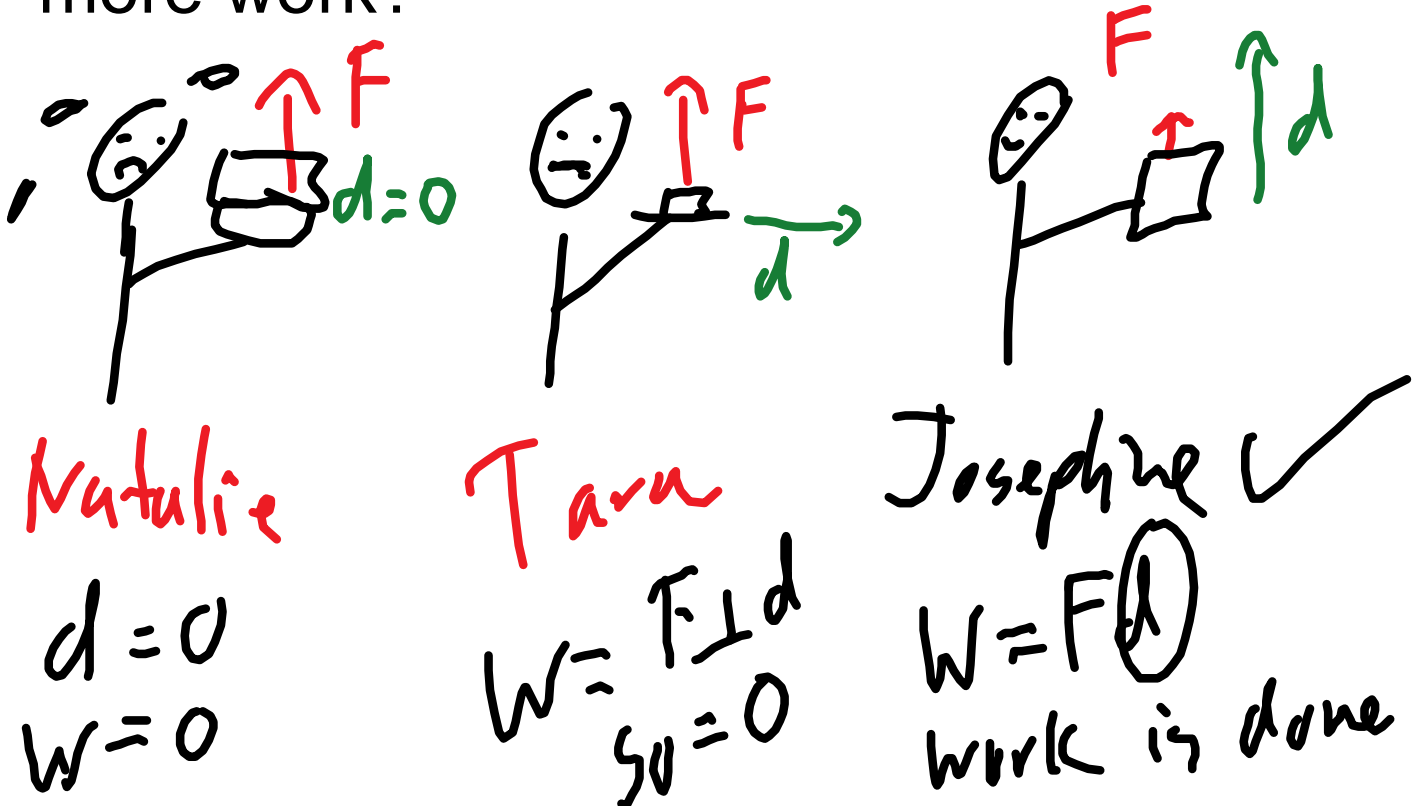
$$W = Fd$$

where F is in the direction of d

if F is perpendicular to d , then no work is done.

if F is opposite d , then work is negative

Given our first definition, who is doing more work?



Eg. A 50.0kg student walk up stairs 4.0 m long and 5.0 m high.

1. determine the work done on the student by

a) the student

fighting gravity $W = Fd = mgd$

$$= 50\text{kg} \times 9.8\text{N/kg} \times 5.0\text{m} = 2450\text{Nm}$$

2450J Joule is a Nm

b) gravity

gravity is down, while d is up so
 $W = -2450\text{J}$ (negative when F is
opposite d)

c) normal force

$W = 0$ because $d = 0$ the stairs are not
moving

d) friction force

$W = 0$ it is not sliding

2. If the student goes up the same height
in an elevator, determine the work done
on the student by a,b,c,d.

a) $W = 0\text{J}$ You are just standing there in the
elevator.

b) $W = -2450\text{J}$ (same force, same d)

c) $W = +2450\text{J}$ (floor pushes you up)

d) $W = 0\text{J}$

Field trip form:

p199 Q1-4

p178-189 quiz next class